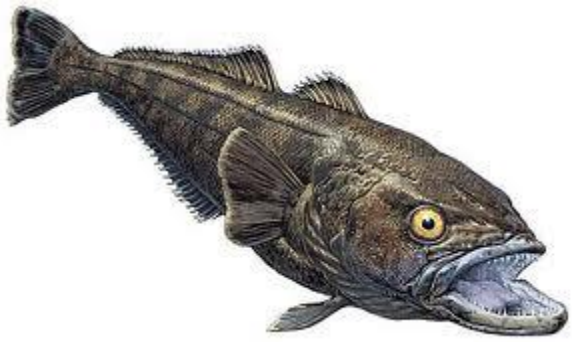
STATUS REPORT

Dissostichus eleginoides

Common Name: Patagonian toothfish

FAO-ASFIS Code: TOP



2016
Updated 14 October 2016

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1. Description of the fishery

1.1 Description of fishing vessels and fishing gear

Fishing for Patagonian toothfish in the SEAFO CA started around 2002. The main fishing countries working in the area include vessels from Japan, the Republic of Korea, Spain and South Africa. Historically a maximum of four vessels per year fished in the SEAFO CA. The Spanish longline system and the Trotline (Fig. 1) are the fishing gears commonly used.

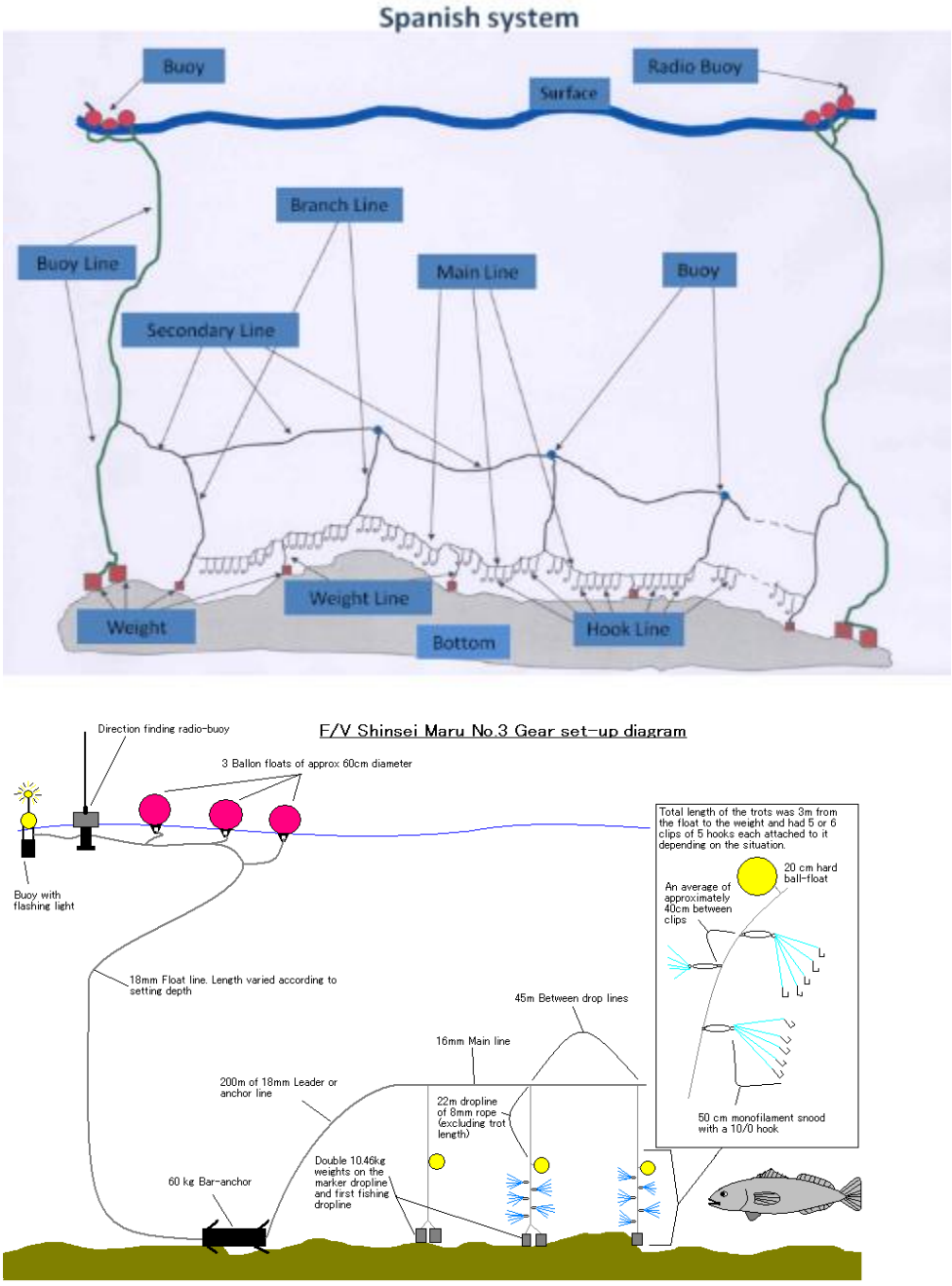
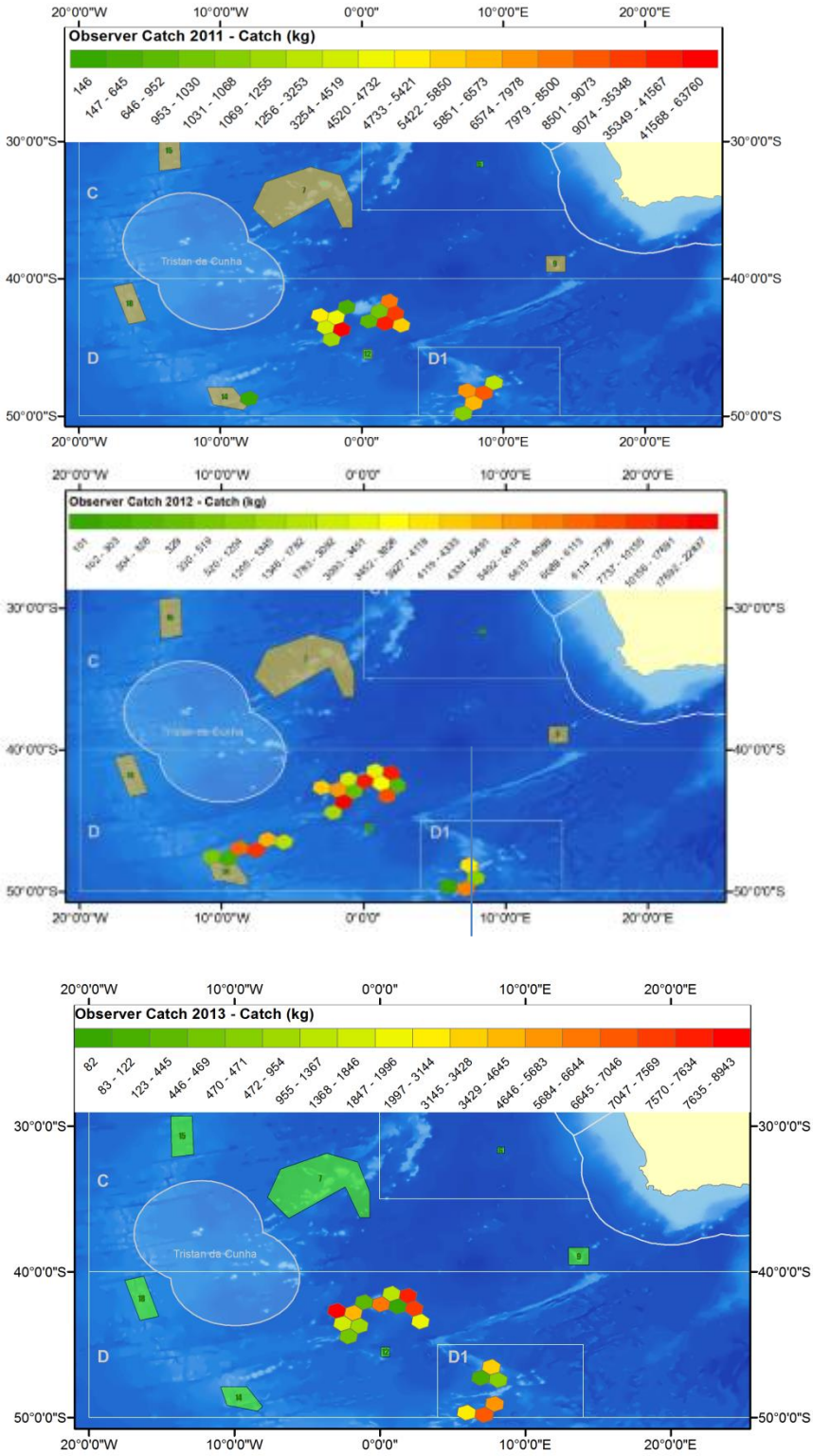


Figure 1: Fishing gears used to fish *D. eleginoides*: Spanish longline system (top) and the Trotline (bottom).

1.2 Spatial and temporal distribution of fishing

In SEAFO CA, the fishery from 2011 to 2014 took place in Sub-Area D, being concentrated over seamounts in Division D1, at Discovery seamount and also at seamounts located in the western part of Sub-Area D (Fig. 2).



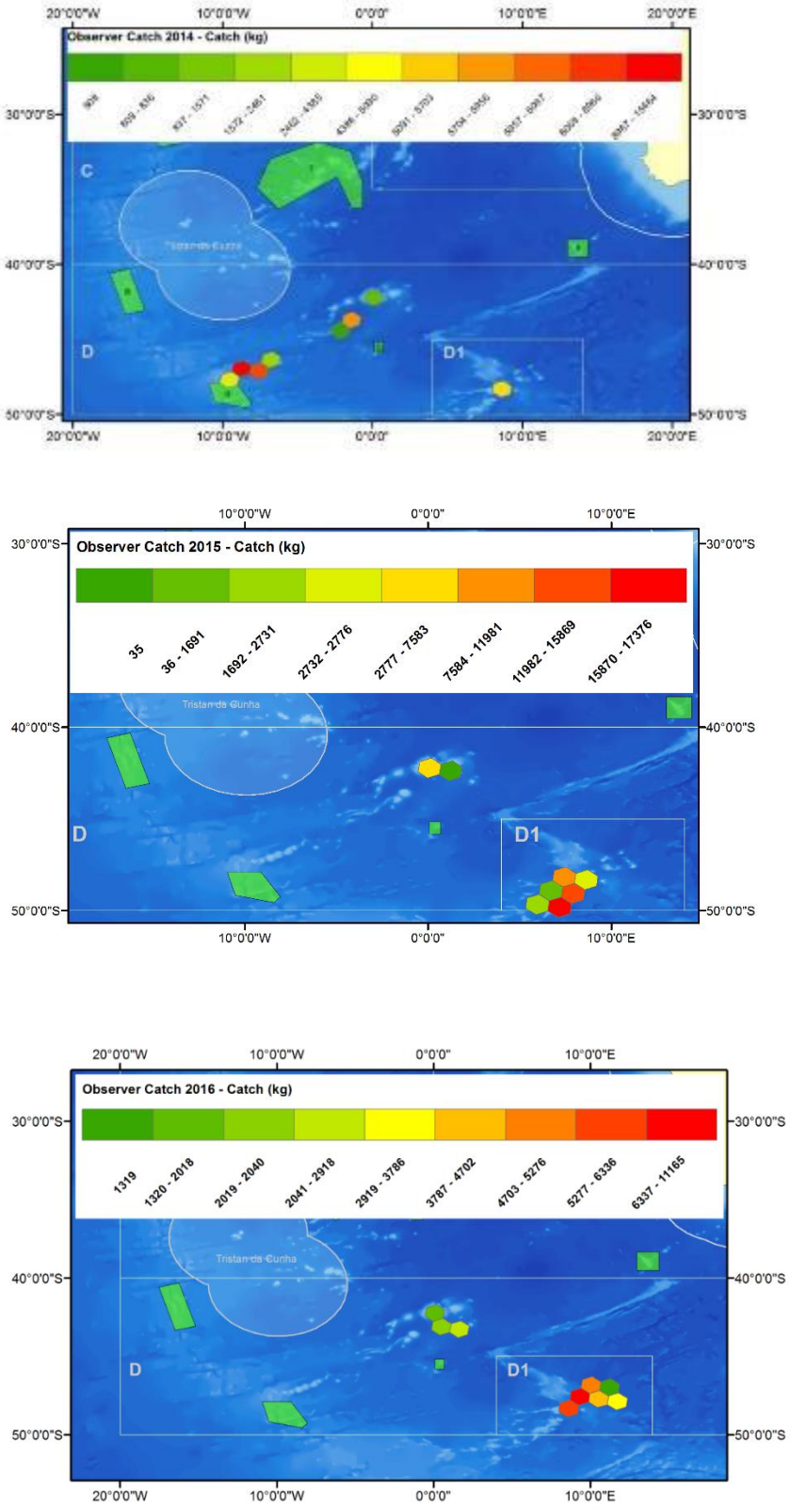


Figure 2: Reported catch of Patagonian toothfish (*Dissostichus* eleginoides) aggregated to 100km diameter hexagonal cells (2011-2016).

Table 1 shows that the main fishing ground is located on Discovery seamount and also in D1 but less hauls were deployed in the western seamounts of Sub-Area D.

Table 1: Number of sets by year and location

Year	Western	Discovery	D1- Meteor
2010	27	5	118
2011	1	207	54
2012	68	207	25
2013	0	108	57
2014	100	64*	13
2015	0	24	127
2016	0	22	67

1.3 Reported retained catches and discards

Table 2A presents data on Patagonian toothfish catches and discards listed by country, as well as fishing gear used and the management area from which catches were taken. Annual catches varied between 18t (2002) and 413t (2007).

Discards were mainly due to parasite infection of fish. In the last three years with complete data (2013, 2014 and 2015) retained catches were 61, 79 and 59t respectively and the annual weight of discarded specimens was 3, 7 and 2 t in the three year period.

Table 2A: Catches (tons) of Patagonian toothfish (*Dissostichuseleginoides*) by South Africa, Spain, Japan and Korea (2002-2016)

Nation	Spain		Japan				Korea				South Africa			
Fishing method	Longlines		Longlines				Longlines				Longlines			
Management Area	D0		D0		D1		D0		D1		D0		D1	
Catch details (t)	Ret.	Disc.	Ret.	Disc.	Ret.	Disc.	Ret.	Disc.	Ret.	Disc.	Ret.	Disc.	Ret.	Disc.
2002	18													
2003	101				47		245	0						
2004	6				124									
2005	N/F	N/F			158		15	0						
2006	11				152		7	0						
2007	N/F		151		15		247	0						
2008	N/F	N/F	19	0	104	0	79	0						
2009	N/F	N/F	82	0	4	0	16	0	48	0	N/F	N/F	N/F	N/F
2010	26	0	41	0	12	2	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2011	N/F	N/F	172	6	N/F	N/F	N/F	N/F	N/F	N/F	15	0	28	0
2012	N/F	N/F	86	3	N/F	N/F	N/F	N/F	N/F	N/F	24	0	12	0
2013	N/F	N/F	41	2	20	1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2014	N/F	N/F	67	6	12	<1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2015	N/F	N/F	7	<1	52	<1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F
2016*	N/F	N/F	7	<1	53	<1	N/F	N/F	N/F	N/F	N/F	N/F	N/F	N/F

N/F = No Fishing. Blank fields = No data available. *Provisional (September 2016).
Ret. = Retained Disc. = Discarded

Table 2B: Atlantic toothfish (*Dissostichus mawsoni*). (TOA) catches and discards

Nation	**Japan**			
Fishing method	**Longlines**			
Management Area	**D0**		**D1**	
Year	Ret..	Disc.	Ret..	Disc.
2014	< 1	0	0	0
2015	0	0	0	0
2016	0	0	0	0

Ret. = Retained Disc. = Discarded

Retained and discarded bycatch from the Patagonian toothfish fishery are presented in Table 3. The two most important species (in terms of weight) are grenadiers (GRV) and Blue antimora (ANT).

1.4 IUU

IUU fishing activity in the SEAFO CA has been reported to the Secretariat latest in 2012, but the extent of IUU fishing is at present unknown.

Table 3**: Retained and discarded bycatch from the Patagonian toothfishfisheries (kg).**

	2009				2010				2011		2012				2013				2014			
	Retained		Discarded		Retained		Discarded		Retained	Discarded	Retained		Discarded		Retained		Discarded		Retained		Discarded	
Species	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**	**D0**	**D0**	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**	**D0**	**D1**
GRV			89	5 833	4 047	1 936	93	2 601		22 414			23 705	186			7 273	869				267
ANT			126	4 786			453	1 348		4 794			4 442	65			796	610			329	106
BYR	1 221		573																			
MCC			336	896																		
BYR																						
BEA	360																					
MZZ								168														
SRX										30			124				20					
MRL			108					1		2			37				1					
COX			2							21			75									
SKH			90																			
LEV			36				4															
KCX				1			3	35									83	10				
HYD													31				17					
BUK							17															
NOX										7												
MWS										6												
ETF																	3					
SEC													2									
SSK							2															
CKH							1	1														
KCF			1																			
TOA																			99			
RTX																					1122	

	2015			
	Retained		Discarded	
Species	D0	D1	D0	D1
GRV			1221	1579
ANT			452	598
BYR				
MCC				
BYR				
BEA				
MZZ				
SRX			16	
MRL			2	
COX				
SKH				
LEV				
KCX				
HYD			233	
BUK				
NOX				
MWS				
ETF			1	
SEC				
SSK				
CKH				
KCF				
TOA				
RTX			146	
BSH			89	
ETF				
HIB			18	
LEV			5	

BSH: Blue shark (*Prionace glauca*); ETF: Blackbelly lanternshark (*Etmopterus Lucifer*); HIB: Deep-water arrowtooth eel (*Histiobranchus bathybius*); LEV: Lepidion codlings nei (*Lepidion spp*);ANT:Blue antimora (*Antimora rostrata*); BEA:Eaton's skate (*Bathyraja eatonii*); BYR:Kerguelen sandpaper skate (*Bathyraja irrasa*); COX:Conger eels, etc. nei (*Congridae*); CKH:Abyssal grenadier (*Coryphaenoides armatus*); BUK:Butterfly kingfish (*Gasterochisma melampus*); HYD:Ratfishes nei (*Hydrolagus spp*); LEV:Lepidion codlings nei (*Lepidion spp*); KCX:King crabs, stone crabs nei (*Lithodidae*); MCC:Ridge scaled rattail (*Macrourus carinatus*); GRV:Grenadiers nei (*Macrourus spp*); MWS:Smallhead moray cod (*Muraenolepis microcephalus*); MRL:Moray cods nei (*Mur aenolepis spp*); NOX:Antarctic rockcods, noties nei (*Nototheniidae*); MZZ:Marine fishes nei (*Osteichthyes*); KCF:Globose king crab (*Paralomis formosa*); ETF:Blackbelly lantern shark (*Etmopterus lucifer*); SEC:Harbour seal (*Phoca vitulina*); SRX:Rays, stingrays, mantas nei (*Rajiformes*); SKH:Various sharks nei (*Selachimorpha(Pleurotremata*)); (Rajiformes); SSK:Kaup's arrowtooth eel (*Synaphobranchus kaupii*).

2. Stock distribution and identity

Patagonian toothfish is a southern circumpolar, eurybathic species (70-1600m), associated with shelves of the sub-Antarctic islands usually north of 55ºS. Young stages are pelagic (North, 2002). The species occurs in the Kerguelen-Heard Ridge, islands of the Scotia Arc and the northern part of the Antarctic Peninsula (Hureau, 1985; DeWitt et al., 1990). This species is also known from the southern coast of Chile northward to Peru and the coast of Argentina, especially in the Patagonian area (DeWitt, 1990), and also present in Discovery and Meteor seamounts in the SE Atlantic (Figure 3) and El Cano Ridge in the South Indian Ocean (López-Abellán and Gonzalez, 1999, López-Abellán, 2005).

In SEAFO CA the stock structure of the species is unknown. The CCAMLR Scientific Committee in 2009 noted that in most years (since 2003) the main species caught in CCAMLR sub-area 48.6 (adjacent to and directly south of SEAFO Division D) is *D. eleginoides*. The distribution of the species appears to be driven by the sub-Antarctic front which extends into the SEAFO CA.

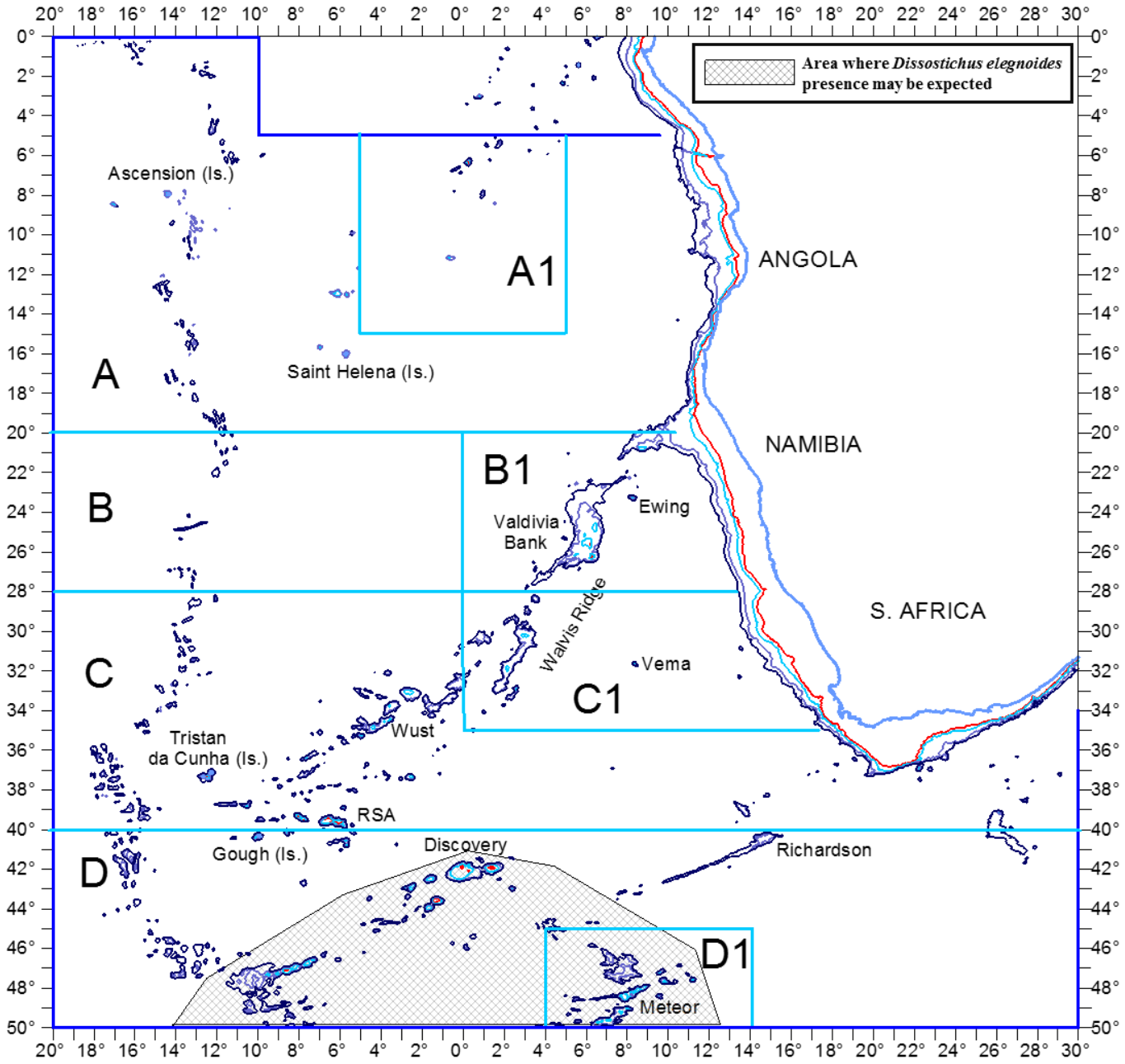


Figure 3: Species geographical distribution in the SEAFO CA (source: Species profile on the SEAFO website).

3. Data available for assessments, life history parameters and other population information

3.1 Fisheries and survey data

The number of fishing sets sampled from 2006 onwards indicates a good sampling level in line with the SEAFO preliminary guidelines for data collection (Table 4). On average 20 specimens were measured per sampled fishing set, which is considered acceptable given the length range of the exploited population. It will be necessary to apply in future this sampling effort of 20 individuals in all sampled fishing sets (Figure 4).

Table 4. Annual analysis of sampling effort conducted on board fishing vessel

Year	No. of Sets sampled	Mean number of Individuals sampled per set	Min. Individuals sampled per set	Max. Individuals sampled per set	Mean sample size/tonne
2006	146	22.16	1	31	-
2007	222	11.61	1	57	-
2008	120	23.69	2	110	-
2009	275	17.97	1	58	0.13
2010	125	26.91	1	60	0.32
2011	263	32.95	1	60	0.16
2012	298	20.58	1	57	0.17
2013	164	19.87	1	70	0.32
2014	176	25.50	3	50	0.48
2015	149	17.23	1	23	0.29

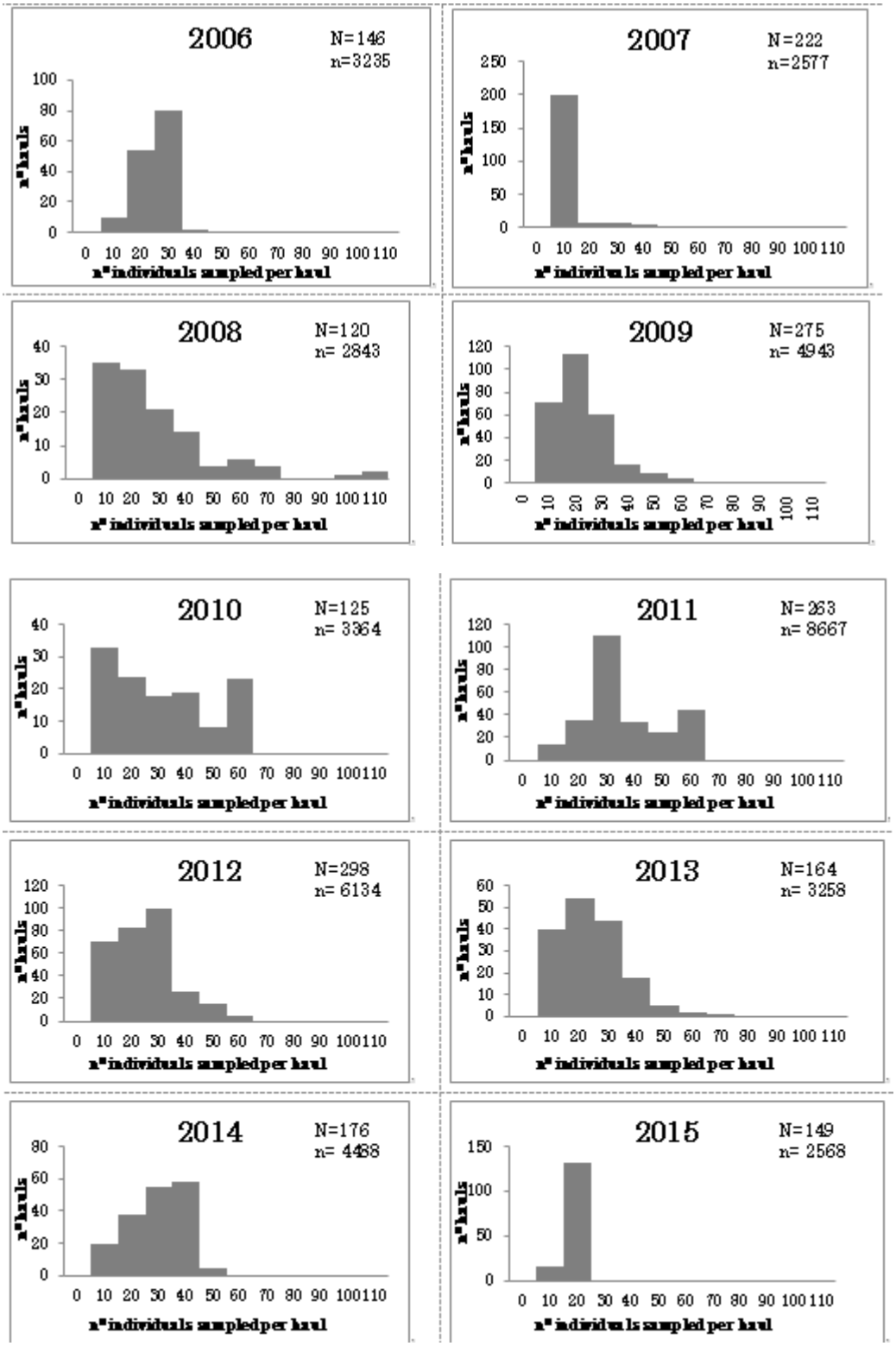


Figure 4: Frequency distribution of sample size per set. Data from Observer Reports submitted to SEAFO. N = number of sets sampled per year; n = total number of individuals sampled.

3.2 Length data and frequency distribution

Figure 5 shows the annual total length frequency distributions of Patagonian toothfish catches based on the observer data from all fleets submitted to SEAFO. Length frequency distributions for the period 2006-2013 suggest a shift towards smaller lengths in the catches in more recent years. The proportion of large fish appears to be declining.

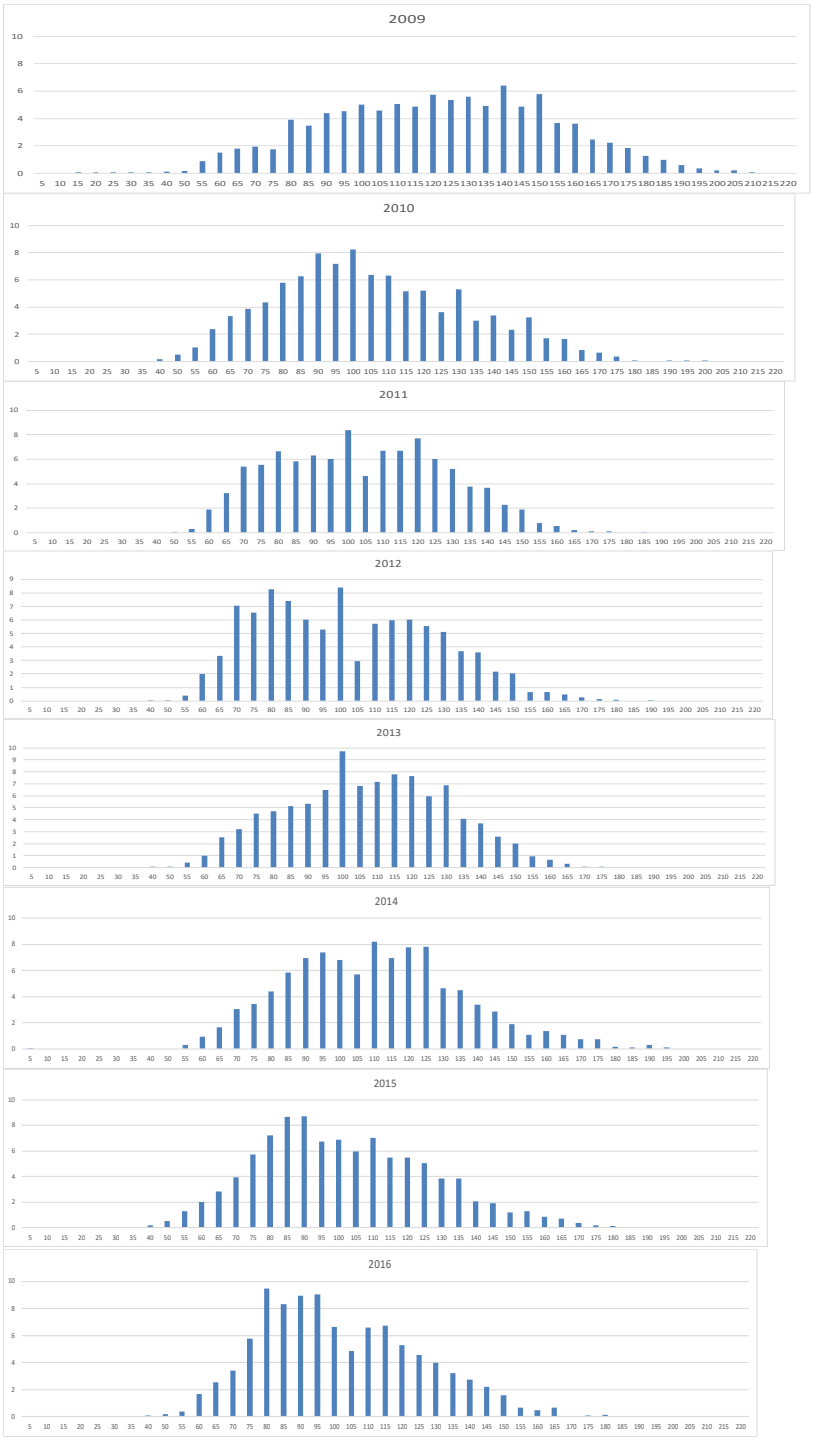


Figure 5: Annual size % frequency distributions *D. eleginoides*raised in SEAFO CA Sub-Area D. (Y axis :0%-10%)

3.3 Length-weight relationships

Table 5 shows the length-weight relationships by sex based on observer data from Japanese fleet in 2013.

Table 5: Length-weight relationships by sex (based on 2013 Japanese observer data)

Samples	a	b	r^2	n
Males	1E-06	3.4484	0.9768	405
Females	2E-06	3.4296	0.9579	860

3.4 Age data and growth parameters
There is no available information for this species in SEAFO CA.

3.5 Reproductive parameters
There is no available information for this species in SEAFO CA.

3.6 Natural mortality
There is no available information for this species in SEAFO CA.

3.7 Feeding and trophic relationships (including species interaction)
There is no available information for this species in SEAFO CA.

3.8 Tagging and migration

Eleven specimens were tagged in Subarea D in 2006 and fourteen in 2010 (Spanish flagged Viking Bay vessel). However, there is no available information on recoveries of tagged specimens or on tagged specimens tagged at adjacent areas of CCAMLR.

4. Stock assessment status
There are no agreed stock assessments.

5. Incidental mortality and bycatch of fish and invertebrates

5.1 Fish bycatch
Table 6 shows the bycatch species in the Patagonian toothfish (*Dissostichus eleginoides)* Fishery and its weights based on the observer reports. SC noted that the major bycatch is grenadiers (Macrouridae - GRV) and the bycatch is discarded. The impact of this bycatch on grenadiers spp. is unknown.

Table 6: VME **Bycatch from Patagonia toothfish fishery (kg)**

	2010		**2011**	**2012**	**2013**	**2014**		**2015**	
Species	**D0**	**D1**	**D0**	**D0**	**D0**	**D0**	**D1**	**D0**	**D1**
Gorgonians (Gorgoniidae)	33.9	13.6	3.8	30.3	2.3	2.6	1.2		0.35
Hard corals, madrepores nei (Scleractinia)	2.1	0.1	15.4	17.6	0.3	2.8			

Black corals and thorny corals (Antipatharia)	3.9	0.5		0.2					
Basket and brittle stars (Ophiuroidea)	1.3	2.0							4.9
Sea pens (Pennatulacea)	1.0	0.3		0.0					
Soft corals (Alcyonacea)	0.2	1.0		1.2					
Feather stars and sea lilies (Crinoidea)	0.9	0.1							
Hydrocorals (Stylasteridae)									1
Sponges								0.4	

5.2 Incidental mortality (seabirds, mammals and turtles)

In the SEAFO database there are records of three seabirds having been caught during Japanese longline daytime fishing in 2014. The seabirds caught were recorded by the ID codes "PUG" – *Puffinus gravis* (Great shearwater) & "DIM" – *Thalassarche melanophris* (Southern black-browed albatross).

5.3 Invertebrate bycatch (VME taxa)

Table 6 shows the bycatch of VME species and its amount based on the observer data for the period 2010-2016. Figure 7 shows their geographic location.

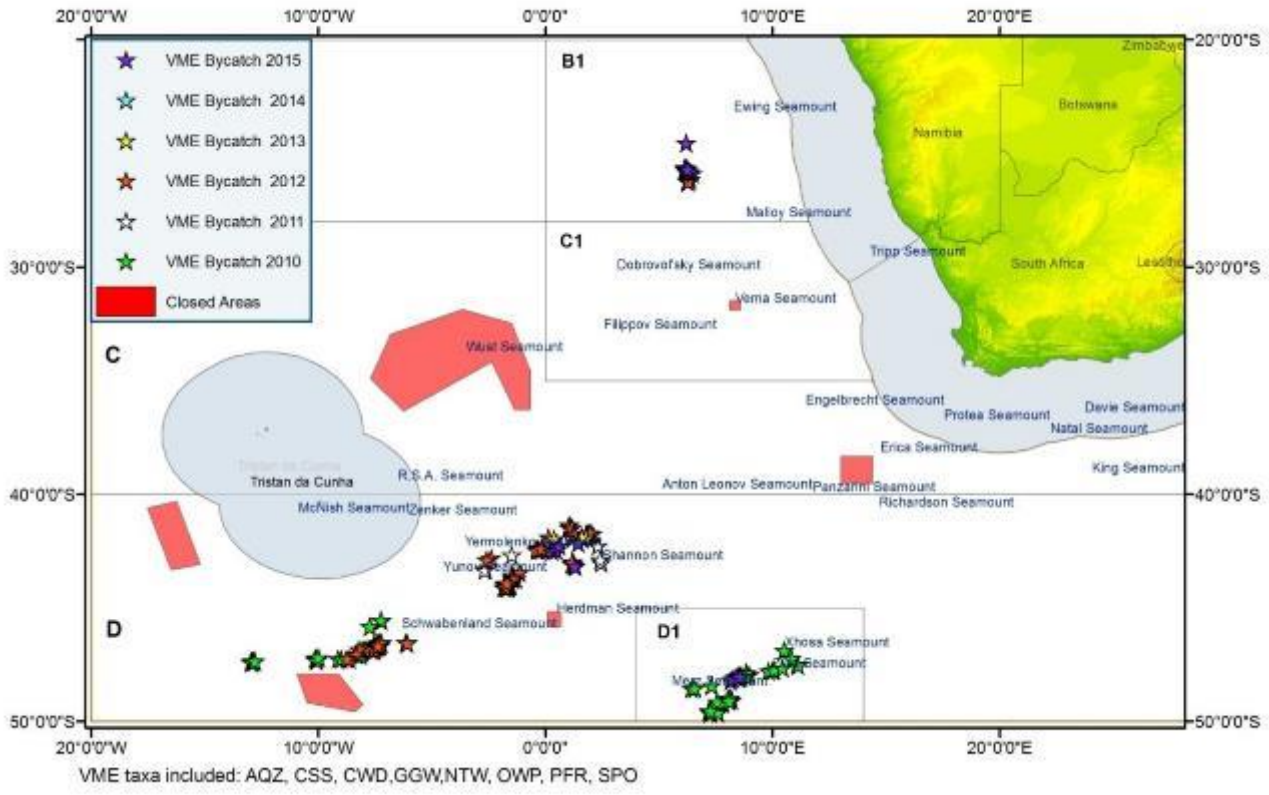


Figure 7: Locations for incidental bycatch of VME species from SEAFO Patagonian toothfish fishery.

5.4 Incidental mortality and bycatch mitigation methods

Offal dumping during hauling and bird scaring devices (Tori lines) are mandated to mitigate seabird bycatch.

5.5 Lost and abandoned gear

Figure 8 shows locations and amount of the lost gears based on the observer data from 2010 to 2013 (no lost gear in 2014-2015).

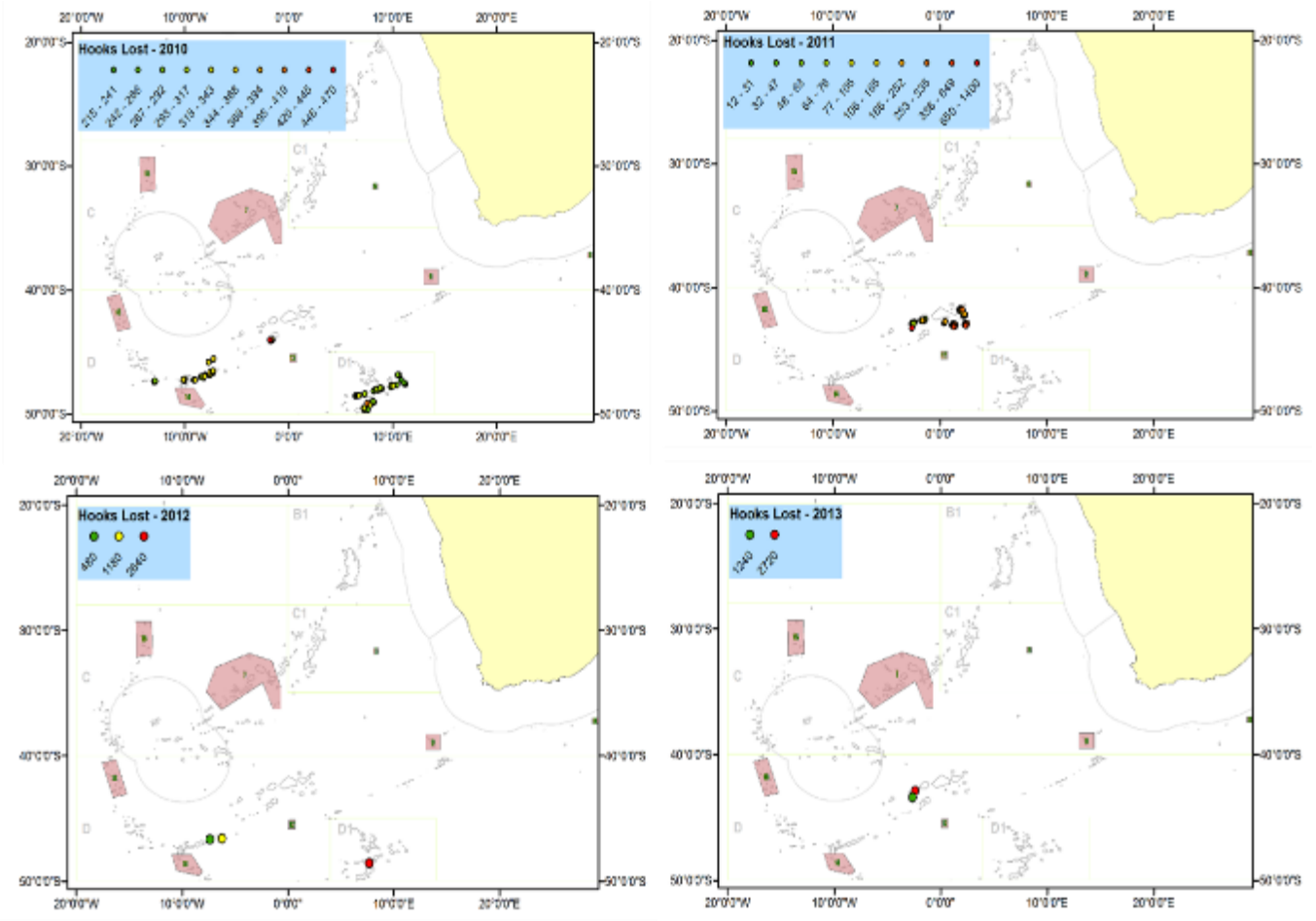


Figure 8: Locations and amount of the lost gears (hooks with attached short line) based on observer data (2010-2013) (no lost gear in 2014-2015).

6. Current conservation measures and management advice

In 2015 the Commission adopted a TAC of 264 t in Sub-Area D applying the harvest control rule, and zero tonnes for the remainder of the SEAFO CA for 2016.

The SC notes that in both 2015 and 2016 about 22% of the TAC was taken (incl. the experimental fishery), hence the fishery is not constrained by the TAC.

The application of the HCR requires as input a 5-year time-series of recent CPUE data. The CPUE series applied in 2015 was derived by pooling all available data in the SEAFO CA. No analysis was made to determine if pooling was a valid approach. Also, the series first discussed in 2016 was not standardised as in 2015, and questions were asked about the consistency of the analysis between years.

The SC explored standardization using generalised linear models (GLM), but the explorations indicated that the variance explained was too low to extract meaningful results, hence further efforts would be required. There were, however, clear indications of significant area-effects, hence pooling of data from different fishing areas was probably not valid.

The SC then resorted to deriving CPUE series for separate fishing areas for which the more extensive continuous time-series of catch and effort data are available in the SEAFO database, i.e. the Meteor and Discovery seamounts. Data from the Western part were excluded from the assessment as the time series was not complete. Only Japanese data within the 2011 agreed footprint, i.e. from the party taking the bulk of the catch in all years, were used in order to retain consistency through the time series.

It is uncertain whether the two CPUE series shown in Fig. 9 reflects abundance, but in the absence of other alternatives, the series from Meteor and Discovery were considered valid for the derivation of TACs using the recommended and accepted HCR.

The CPUE series as derived both have best estimates of slope close to zero. For Discovery the best estimate is slightly negative, for Meteor the estimated slope was zero (Fig. 9).

Applying the HCR based on a weighted average of the CPUE slopes on Meteor and Discovery a TAC estimate of 266 t was derived. **The SC recommends a TAC for Subarea D of 266 t and a zero TAC for the remainder of the SEAFO CA for the years 2017 and 2018.**

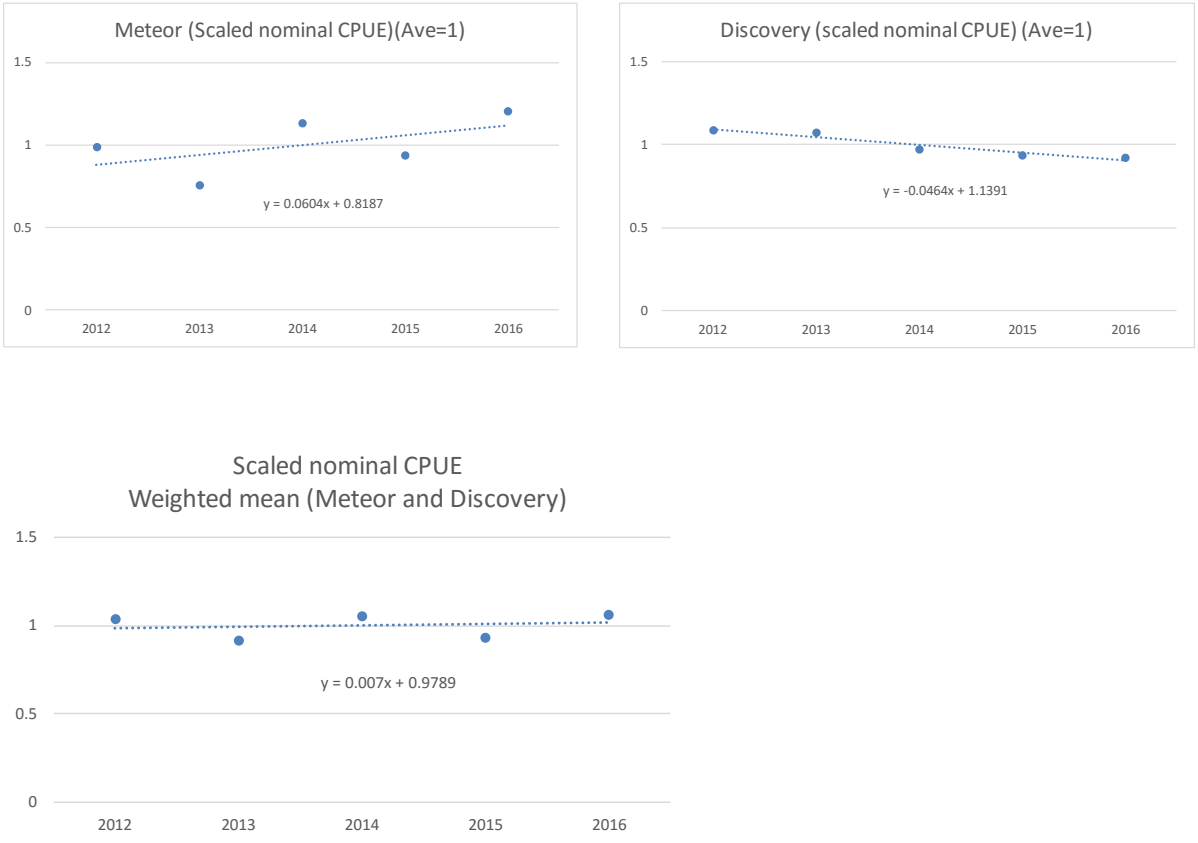


Figure 9: Upper: Average slope in Meteor (left) and Discovery(right) for 5 years CPUE (2012-2016)
Lower: Average slope based on the weighted average of two slopes.

Other Conservation Measures that are applicable to this fishery can be seen in Table 7.

Table 7: Other Conservation Measures that are applicable to this fishery.

Conservation Measure 04/06	On the Conservation of Sharks Caught in Association with Fisheries Managed by SEAFO
Conservation Measure 14/09	To Reduce Sea Turtle Mortality in SEAFO Fishing Operations.
Conservation Measure 25/12	On Reducing Incidental Bycatch of Seabirds in the SEAFO Convention Area
Conservation Measure 30/15	On the Management of Vulnerable Deep Water Habitats and Ecosystems in the SEAFO Convention Area
Conservation Measure 31/15	On Total Allowable Catches and related conditions for Patagonian Toothfish, orange roughy, Alfonsino and Deep-Sea Red Crab in the SEAFO Convention Area in 2014

7. References

Arana, P.2009. Reproductive aspects of the Patagonian toothfish (Dissostichus eleginoides) off southern Chile. Lat. Am. J. Aquat. Res., 37(3): 381-394.

Dewitt, H.H., P.C. Heemstra and O. Gon. 1990. Nototheniidae. In: Fishes of the Southern Ocean, O. Gon and P.C. Heemstra (Eds.). J.L.B. Smith Institute of Ichthyology, Grahamstown, South Africa: 279-331.

Horn P. L. 2002. Age and growth of Patagonian toothfish (Dissostichus eleginoides) andAntarctic toothfish (D. mawsoni) in waters from the New Zealand subantarctic to the Ross Sea,Antarctica Fisheries Research, 56:275-287.

Hureau, J.C, 1985. Family Nothoteniidae-Antarctic rock cods. In: FAO species identification sheets for fishery purposes. Southern Ocean: Fishing Areas 48, 58 and 88 (CCAMLR Convention Area). Fischer, W. And J.C. Hureau (Eds). FAO, Rome, vols. I-II, 470 p.

López-Abellán L.J. and J. González. 1999. Results of the longline survey on the seamounts in the southeast Atlantic and in the CCAMLR Subarea 48.6 (Atlantic Ocean) and Division 58.4.4 (Indian Ocean). CCAMLR Science, Vol. 6: 99-116.

López-Abellán, L.J. 2005. Patagonian toothfish in international waters of the Southwest Indian Ocean (Statistical Area 51). CCAMLR Science, 12: 207–214.

SC-SEAFO-2011. Report of the 7th Annual Meeting of the SEAFO Scientific Committee. *SEAFO SC Report 2011*. SEAFO, Swakopmund, Namibia.

SC-SEAFO-2013. Report of the 9th Annual Meeting of the SEAFO Scientific Committee. *SEAFO SC Report 2013*. SEAFO, Swakopmund, Namibia.

Annex A: Biological data collected

Sex information collected (2009-2016)

	2009	2010	2011	2012	2013	2014	2015	2016	total
	1	22				399			422
ANT	39	464				607	48	86	1244
BOA								1	1
BSH							1	1	2
BYR	18								18
CGE								11	11
ETF								1	1
GRV		655						197	852
HIB								2	2
KCU								1	1
KCX		29						35	64
MCC	84						165	234	483
MCH							463	641	1104
MRL								1	1
QMC							198		198
RTX						958	60		1018
SRX							2		2
TOA						11			11
TOP	4931	3364	8652	6095	3247	1754	2564	1551	32158
total	**5073**	**4534**	**8652**	**6095**	**3247**	**3729**	**3501**	**2762**	**37593**

Number of otolith collected for TOP:

	TOP
2014	533
2015	732
2016	749

Gonad information collected:

	ANT	MCC	MRL	TOA	TOP	total
2014				9	533	542
2015					732	732
2016	14	40	1		749	804
total	**14**	**40**	**1**	**9**	**2014**	**2078**

APPENDIX X **– Stock Status Report – Alfonsino**

STATUS REPORT

Beryx splendens
Alfonsino

2016

Updated 14 October 2016